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EXAMINER	
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ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/688,420	KLOCKE ET AL.	
	Examiner	Art Unit	
	Edna Wong	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-69* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-69* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *January 26, 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Specification

The disclosure is objected to because of the following informalities:

page 11, line 21, the word "suppressers" should be amended to the word -- suppressors --.

page 14, line 7, the words -- filed on August 30, 1999 and now US Patent No. 6,280,583 -- after the number "09/385,784".

page 14, line 8, the words -- filed on August 31, 1999 and now US Patent No. 6,309,520 -- after the number "09/386,803".

page 14, line 8, the words -- filed on August 31, 1999 and now US Patent No. 6,309,524 -- after the number "09/386,610".

page 14, line 8, the words -- filed on August 31, 1999 and now US Patent No. 6,303,010 -- after the number "09/386,197".

page 14, line 8, the words -- filed on February 9, 2000 and now US Patent No. 6,471,913 -- after the number "09/501,002".

page 14, line 8, the words -- filed on December 8, 2000 and now US Patent No.

6,780,374 -- after the number "09/733,608".

page 14, line 8, the words -- filed on March 12, 2001 and now US Patent No. 6,569,297 -- after the number "09/804,696".

Appropriate correction is required.

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

Claims **1-2, 28 and 31** are objected to because of the following informalities:

CLaim1

line3, the word -- and -- should be inserted after the word "acid;".

Claim 2

line 2, the word -- a -- should be inserted after the word "is".

Claim 28

line 2, the word -- a -- should be inserted after the word "is".

Claim 31

line 2, the word -- a -- should be inserted after the word "is".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

I. Claims **63-65** are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for electrodepositing, does not reasonably provide enablement for electrolessly depositing. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims.

Claim 63

line 4, recites "depositing".

Applicants' specification discloses electroplating methods (page 5, line 11). However, claim 63, as presently written, reads on electrolessly depositing the copper. Thus, the claims are not commensurate in scope with the specification.

II. Claims **5, 9, 12-13, 20-21, 24, 28, 30-32, 37, 41, 46, 50, 57, 61, 64-65 and 67** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 5

lines 1-2, the composition already comprises from about 30 to about 60 ppm halide ion (from claim 4, lines 1-2). However, it is unclear if the composition *further comprises* an additional from about 30 to about 60 ppm HCl.

Claim 9

line 2, the tradename "shipley C-3100 suppressor" is indefinite.

Claim 12

line 2, the tradename "shipley B-3100 accelerator" is indefinite.

Claim 13

line 2, "SPS" is indefinite.

Claim 20

line 1, "the glycol-based suppressor" lacks antecedent basis.

Claim 21

lines 1-2, it appears that "a copper-deposition accelerator" is the same as that recited in claim 19, line 5. However, it is unclear if it is. If it is, then it is suggested that the words "further comprising" be deleted and replaced with the word -- wherein --, and the word "a" be amended to the word -- the --.

Claim 28

line 2, the tradename "shipley C-3100 suppressor" is indefinite.

Claim 30

lines 1-2, it appears that "a copper-deposition accelerator" is the same as that recited in claim 26, line 5. However, it is unclear if it is. If it is, then it is suggested that the words "further comprising" be deleted and replaced with the word -- wherein --, and the word "a" be amended to the word -- the --.

Claim 31

line 2, the tradename "shipley C-3100 suppressor" is indefinite.

Claim 32

line 2, "SPS" is indefinite.

Claim 37

lines 1-2, it appears that "a copper-deposition accelerator" is the same as that recited in claim 35, line 6. However, it is unclear if it is. If it is, then it is suggested that the words "further comprising" be deleted and replaced with the word -- wherein --, and the word "a" be amended to the word -- the --.

Claim 41

lines 1-2, it appears that "a copper-deposition accelerator" is the same as that recited in claim 35, line 6. However, it is unclear if it is. If it is, then it is suggested that the words "further comprising" be deleted and replaced with the word -- wherein --, and the word "a" be amended to the word -- the --.

Claim 46

lines 1-2, it appears that "a copper-deposition accelerator" is the same as that recited in claim 44, line 5. However, it is unclear if it is. If it is, then it is suggested that the word "a" be amended to the word -- the --.

Claim 50

lines 1-2, it appears that "a copper-deposition accelerator" is the same as that recited in claim 44, line 5. However, it is unclear if it is. If it is, then it is suggested that the words "further comprising" be deleted and replaced with the word -- wherein --, and

the word "a" be amended to the word -- the --.

Claim 57

line 2, "processing" lacks antecedent basis.

Claim 61

line 2, it appears that the "copper" is the same as that recited in claim 55, line 4. However, it is unclear if it is. If it is, then it is suggested that the word -- the -- be inserted after the word "depositing".

lines 2-3, "the same plating tool" lacks antecedent basis.

Claim 64

line 3, it appears that "a copper-deposition suppressor" is the same as that recited in claim 63, line 7. However, it is unclear if it is. If it is, then it is suggested that the word "a" be amended to the word -- the --.

lines 3-4, it appears that "a copper-deposition accelerator" is the same as that recited in claim 63, lines 6-7. However, it is unclear if it is. If it is, then it is suggested that the word "a" be amended to the word -- the --.

Claim 65

line 3, it appears that "a copper-deposition suppressor" is the same as that recited in claim 63, line 7. However, it is unclear if it is. If it is, then it is suggested that the word "a" be amended to the word -- the --.

lines 3-4, it appears that "a copper-deposition accelerator" is the same as that recited in claim 63, lines 6-7. However, it is unclear if it is. If it is, then it is suggested that the word "a" be amended to the word -- the --.

Claim 67

line 3, it appears that "a copper-deposition suppressor" is the same as the glycol-based suppressor recited in claim 66, line 12. However, it is unclear if it is.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Composition

I. Claims **1-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No.

6,024,857) ['857].

Reid '796 teaches an aqueous-based electroplating composition comprising:

(a) about 35 to about 60 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; col. 7, Table 1; and col. 8, Table 2];

(b) about 65 to about 150 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-7; col. 7, Table 1; and col. 8, Table 2];

(c) a glycol-based suppressor (col. 4, lines 26-36).

The glycol-based suppressor is present at a concentration of from about 2 to about 30 ml/L (= 0.5-8 ml/l) [col. 7, Table 1].

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 30 ml/L (= 1-6 ml/l) [page 7, Table 1].

The composition further comprises from about 10 to about 100 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition further comprises from about 30 to about 60 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the chloride ions are from HCl.

Like Reid '796, Reid '857 teaches an aqueous-based electroplating composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from HCl because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

II. Claims **6-14** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

Reid '796 teaches an electroplating composition comprising:

(a) about 35 to about 60 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; col. 7, Table 1; and col. 8, Table 2];

(b) about 65 to about 150 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-7; and col. 7, Table 1; and col. 8, Table 2]; and

(c) about 2 to about 30 ml/L of a copper-deposition suppressor (= 0.5-8 ml/L) [col. 7, Table 1];

wherein the balance of the composition is water.

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 30 ml/L (= 1-6 ml/l) [page 7, Table 1].

The copper-deposition suppressor is a random or block copolymer (col. 4, lines

26-36).

The copper-deposition suppressor is glycol-based (col. 4, lines 26-36).

The copper-deposition suppressor is copper bath viaform suppressor or Shipley C-3100 suppressor (col. 4, lines 26-36).

The copper-deposition accelerator is SPS (= bissulfopropyl disulfide) [col. 4, line 21].

The composition further comprises from about 10 to about 100 ppm halide ions (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition of Reid of differs from the instant invention because Reid does not disclose wherein the chloride ions are from HCl.

Like Reid '796, Reid '857 teaches an electroplating composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from HCl because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

III. Claims **15-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent

No. 6,024,857) ['857].

Reid '796 teaches an aqueous electroplating composition comprising:

(a) about 35 to about 60 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; col. 7, Table 1; and col. 8, Table 2];

(b) about 65 to about 150 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-7; and col. 7, Table 1; and col. 8, Table 2];

(c) about 2 to about 30 ml/L copper-deposition accelerator (= 1-6 ml/l) [page 7, Table 1];

(d) about 2 to about 30 ml/L of a copper-deposition suppressor (= 0.5-8 ml/L) [col. 7, Table 1]; and

(e) about 40 to about 60 ppm chloride ions (= 20-200 mg/l) [col. 7, Table 1].

The copper-deposition suppressor is glycol-based (col. 4, lines 26-36).

The copper-deposition accelerator is a sulphur containing compound (col. 4, lines 10-25).

The composition further comprises about 50 ppm chloride ions (= 20-200 mg/l) [col. 7, Table 1].

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the chloride ions are from hydrogen chloride.

Like Reid '796, Reid '857 teaches an aqueous electroplating composition

comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from hydrogen chloride because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

IV. Claims **19-25** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

Reid '796 teaches an electroplating composition comprising:

(a) about 45 to about 55 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; col. 7, Table 1; and col. 8, Table 2];

(b) about 75 to about 120 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-7; and col. 7, Table 1; and col. 8, Table 2];

(c) a copper-deposition suppressor (col. 4, lines 26-36)]; and

(d) a copper-deposition accelerator (col. 4, lines 10-26).

The glycol-based suppressor (col. 4, lines 26-36) is at a concentration of from about 2 to about 10 ml/L (= 0.5-8 ml/l) [col. 7, Table 1].

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 8 ml/L (= 1-6 ml/l) [col. 7,

Table 1].

The copper-deposition accelerator is a sulphur containing compound (col. 4, lines 10-25).

The composition further comprises a leveler (col. 4, line 37 to col. 5, line 5).

The composition further comprises from about 10 to about 100 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition further comprises from about 30 to about 60 ppm chloride ions (= 20-200 mg/l) [col. 7, Table 1].

The composition further comprises a leveler (col. 4, line 37 to col. 5, line 5).

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the chloride ions are from hydrogen chloride.

Like Reid '796, Reid '857 teaches an electroplating composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from hydrogen chloride because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

V. Claims **26-33** are rejected under 35 U.S.C. 103(a) as being unpatentable over

Reid et al. (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

Reid '796 teaches an electroplating composition comprising:

(a) an aqueous mixture of copper and sulfuric acid wherein the ratio in g/L of solution of copper to acid is equal to about 0.4 to about 0.8 (col. 8, Table 2).

(b) a copper-deposition accelerator (col. 4, lines 10-25); and

(c) a copper-deposition suppressor (col. 4, lines 26-36).

The copper-deposition suppressor is a random or block copolymer (col. 4, lines 26-36).

The copper-deposition suppressor is copper bath viaform suppressor or Shipley C-3 100 suppressor (col. 4, lines 26-36).

The copper-deposition suppressor is glycol-based (col. 4, lines 26-36).

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present in a concentration of from about 2 to about 30 ml/L (= 1-6 ml/l) [page 7, Table 1].

The copper-deposition accelerator is copper bath viaform accelerator or Shipley B-3100 accelerator (col. 4, lines 10-25).

The copper-deposition accelerator is SPS (= bissulfopropyl disulfide) [col. 4, line 21].

The composition further comprises from about 10 to about 100 ppm chloride ions (= 20-200 mg/l) [col. 7, Table 1].

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the chloride ions are from hydrogen chloride.

Like Reid '796, Reid '857 teaches an electroplating composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from hydrogen chloride because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

VI. Claim **34** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796].

Reid '796 teaches an electroplating composition comprising:

(a) an aqueous-based mixture of copper and sulfuric acid wherein the ratio in g/L solution of copper to acid is equal to about 0.3 to about 0.8 (col. 8, Table 2);

(b) a copper-deposition accelerator (col. 4, lines 10-25); and

(c) a copper-deposition suppressor (col. 4, lines 26-36);

wherein only electroplating compositions comprising a mixture of copper and sulfuric acid wherein the ratio in g/L of copper to acid is equal to about 0.3 to about 0.8 are used

to deposit copper on a workpiece (col. 8, Table 2).

VII. Claims **35-43** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

Reid '796 teaches an electroplating composition comprising:

(a) an aqueous mixture of copper and sulfuric acid wherein the copper concentration in the composition is within about 60% to about 90% of its solubility limit when the sulfuric acid concentration is from about 65 to about 150 g/L (= 0-300 g/l) [col. 7, Table 1; and col. 8, Table 2);

(b) a copper-deposition suppressor (col. 4, lines 26-36); and

(c) a copper-deposition accelerator (col. 4, lines 10-25).

The copper-deposition suppressor is present at a concentration of from about 2 to about 30 ml/L (= 0.5-8 ml/l) [col. 7, Table 1].

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 30 ml/L (= 1-6 ml/l) [col. 7, Table 1].

The composition further comprises from about 10 to about 100 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition further comprises from about 30 to about 60 ppm chloride ions (= 20-200 mg/l) [col. 7, Table 1].

The copper-deposition suppressor is at a concentration of from about 2 to about 10 ml/L (= 0.5-8 ml/l) [col. 7, Table 1].

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 8 ml/L (= 1-6 ml/l) [col. 7, Table 1].

The copper-deposition accelerator is a sulphur containing compound (col. 4, lines 10-25).

The copper-deposition suppressor is glycol-based (col. 4, lines 26-36).

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the chloride ions are from hydrogen chloride.

Like Reid '796, Reid '857 teaches an electroplating composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from hydrogen chloride because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

VIII. Claims **44-52** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent

No. 6,024,857) ['857].

Reid '796 teaches an electroplating composition comprising:

(a) about 40 g/L copper (= 10-60 g/l) [col. 7, Table 1];

(b) about 100 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-7; and col. 7, Table 1; and col. 8, Table 2];

(c) a copper-deposition suppressor (col. 4, lines 26-36); and

(d) a copper-deposition accelerator (col. 4, lines 10-25).

The copper-deposition suppressor is present at a concentration of from about 2 to about 30 ml/L (= 0.5-8 ml/l) [col. 7, Table 1].

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 30 ml/L (= 1-6 ml/l) [col. 7, Table 1].

TThe composition further comprises from about 10 to about 100 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition further comprises from about 30 to about 60 ppm chloride ions (= 20-200 mg/l) [col. 7, Table 1].

The copper-deposition suppressor is at a concentration of from about 2 to about 10 ml/L (= 0.5-8 ml/l) [col. 7, Table 1].

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 8 ml/L (= 1-6 ml/l) [col. 7, Table 1].

The copper-deposition accelerator is a sulphur containing compound (col. 4, lines 10-25).

The copper-deposition suppressor is glycol-based (col. 4, lines 26-36).

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the chloride ions are from hydrogen chloride.

Like Reid '796, Reid '857 teaches an electroplating composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from hydrogen chloride because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

IX. Claims **53 and 54** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

Reid '796 teaches an electroplating composition comprising:

(a) about 50 g/L copper (= 10-60 g/l) [col. 7, Table 1];

(b) about 80 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-7;

and col. 7, Table 1; and col. 8, Table 2];

(c) about 2 to about 10 ml/L (= 0.5-8 ml/L) [col. 7, Table 1] copper-deposition suppressor (col. 4, lines 26-36); and

(d) about 2 to about 8 ml/L (= 1-6 ml/l) [col. 7, Table 1] copper-deposition accelerator (col. 4, lines 10-25).

The composition further comprises from about 10 to about 100 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

Method

X. Claims **55-56, 58, 60 and 62** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Uzoh et al.** (US Patent Application Publication No. 2002/0033342 A1).

Reid '796 teaches a method for plating a workpiece comprising:

(a) providing a workpiece **10** having a plurality of device features **14, 16** including a seed layer **18** wherein the plurality of device features is to be metallized (col. 3, lines 31-43; and Fig 1);

(b) depositing copper within the plurality of device features (col. 6, "Bottom-up Filling Phase") utilizing an electroplating composition comprising about 35 to about 60 g/L copper (= 10-60 g/l), about 65 to about 150 g/L sulfuric acid (= 0-300 g/l), and a glycol-based suppressor (col. 4, lines 26-36; col. 7, Table 1; and col. 8, Table 2).

The method further comprises a seed enhancement procedure (col. 5, "Initiation Phase").

The method further comprises selective etching of copper deposited on the workpiece (= CMP) [col. 8, line 1; and lines 49-50].

The electroplating composition comprises from about 35 to about 60 g/L copper (= 10-60 g/l), from about 65 to about 150 g/L sulfuric acid (= 0-300 g/l), and from about 2 to about 30 ml/L of a copper-deposition suppressor (0.5-8 ml/l) (col. 7, Table 1; and col. 8, Table 2).

The method of Reid '796 of differs from the instant invention because Reid '796 does not disclose annealing the workpiece at temperatures below about 100°C.

Like Reid '796, Uzoh teaches a method for plating a workpiece. Uzoh teaches that for optimum interconnect performance, it is highly desirable to stabilize the structure by annealing the deposited copper. The annealing temperature may range from 60°C in an inert ambient such as nitrogen or in a reducing ambient, or even in a vacuum chamber (page 6, [0073]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Reid '796 by annealing the workpiece at temperatures below about 100°C because the structure would have been stabilized by annealing the deposited copper as taught by Uzoh (page 6, [0073]).

XI. Claims **57, 59 and 61** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Uzoh et al.**

(US Patent Application Publication No. 2002/0033342 A1) as applied to claims 55-56, 58, 60 and 62 above, and further in view of **Basol** (US Patent No. 6,833,063 B2).

Reid '796 and Uzoh are as applied above and incorporated herein.

The method of Reid '796 and Uzoh of differs from the instant invention because they do not disclose the following:

a. Rinsing and drying the workpiece during processing, wherein the rinsing and/or the drying occurs in a chamber in which the deposition of copper is performed, as recited in claim 57.

b. Cleaning the backside of the workpiece after copper is deposited on the workpiece, as recited in claim 59.

c. Precleaning the workpiece prior to depositing copper wherein the precleaning of the workpiece is performed in the same plating tool in which the deposition is performed, as recited in claim 61.

Like Reid '796, Basol teaches a method for plating a workpiece. Basol teaches a system that allows for edge conductor removal, workpiece front surface cleaning, or both to be performed in the same processing chamber that is used for deposition or removal processing of the workpiece (col. 3, lines 61-65; and col. 14, claim 7). This allows for more efficient processing, including the removal of edge copper from a front face of the wafer, and removal of edge copper as part of other cleaning processes (col. 3, lines 34-38).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Reid '796 by rinsing and drying the workpiece during processing, wherein the rinsing and/or the drying occurs in a chamber in which the deposition of copper is performed; cleaning the backside of the workpiece after copper is deposited on the workpiece; and precleaning the workpiece prior to depositing copper wherein the precleaning of the workpiece is performed in the same plating tool in which the deposition is performed because this would have allowed for more efficient processing, including the removal of edge copper from a front face of the wafer, and removal of edge copper as part of other cleaning processes as taught by Basol (col. 3, lines 34-38).

XII. Claims **63-65** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

Reid '796 teaches a method for plating a workpiece comprising:

(a) providing a workpiece **10** having a plurality of device features **14, 16** including a seed layer **18** wherein the plurality of device features is to be metallized (col. 3, lines 31-43; and Fig 1);

(b) depositing copper within the plurality of device features (col. 6, "Bottom-up Filling Phase") utilizing an electroplating composition comprising from about 35 to about 60 g/L copper (= 10-60 g/l), from about 65 to about 150 g/L sulfuric acid (= 0-300 g/l),

from about 2 to about 30 ml/L copper-deposition accelerator (= 1-6 m/l), from about 2 to about 30 ml/L copper-deposition suppressor (0.5-8 ml/l); and from about 40 to about 60 ppm chloride ions (= 20-200 mg/l) [col. 4, lines 26-36; col. 7, Table 1; and col. 8, Table 2].

The electroplating composition comprises a mixture of copper and sulfuric acid wherein the ratio in g/L of copper to acid is equal to about 0.4 to about 0.8 (col. 8, Table 2), a copper-deposition suppressor (col. 4, lines 26-36), and a copper-deposition accelerator (col. 4, lines 10-25).

The electroplating composition comprises a mixture of copper and sulfuric acid wherein the ratio in g/L of copper to acid is equal to about 0.3 to about 0.8 (col. 8, Table 2), a copper-deposition suppressor (col. 4, lines 26-36), and a copper-deposition accelerator (col. 4, lines 10-25) and wherein only electroplating compositions comprising a mixture of copper and sulfuric acid wherein the ratio in g/L of copper to acid is equal to about 0.3 to about 0.8 are used to deposit copper on the workpiece (col. 8, Table 2).

The method of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the chloride ions are from hydrogen chloride.

Like Reid '796, Reid '857 teaches an electroplating composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the

invention was made to have modified the chloride ions described by Reid '796 with wherein the chloride ions are from hydrogen chloride because HCl is a conventional source of chloride ions for use in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

XIII. Claims **66 and 67** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1).

Reid '796 teaches a process for applying a metallization interconnect structure, comprising:

(a) providing a workpiece **10** on which a metal seed layer **18** has been formed using a first deposition process (col. 5, "Entry Phase");

(b) repairing the seed layer by electrochemically depositing additional metal on the seed layer within a principal fluid chamber of a reactor to provide an enhanced seed layer (cols. 5-6, "Initiation Phase"); and

(c) electrolytically depositing a metal on the enhanced seed layer (col. 6, "Bottom-up Filling Phase") utilizing an electroplating composition comprising about 35 to about 60 g/L copper (= 10-60 g/l), about 65 to about 150 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-9; col. 7, Table 1; and col. 8, Table 2], and a glycol-based suppressor (col. 4, lines 26-36).

The electroplating composition comprises from about 35 to about 60 g/L copper

(= 10-60 g/l), from about 65 to about 150 g/L sulfuric acid (= 0-300 g/l) [col. 4, lines 5-9; col. 7, Table 1; and col. 8, Table 2], and from about 2 to about 30 ml/L of a copper-deposition suppressor (0.5-8 ml/l) [col. 7, Table 1].

The method of Reid '796 of differs from the instant invention because Reid '796 does not disclose using a deposition process comprising supplying electroplating power to a plurality of concentric anodes disposed at different positions within the principal fluid flow chamber relative to the workpiece.

Like Reid '796, Wilson teaches a process for applying a metallization interconnect structure. Wilson teaches that the current is applied by a plurality of electrodes in a manner that can account for different plating characteristics at different portions of the workpiece, and the current applied to individual electrodes is changed to account for changes in behavior as thickness of the conductive material on the workpiece increases. As a result, conductive material such as copper are deposited on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the desired properties (page 2, [0010] and [0011]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Reid '796 by using a deposition process comprising supplying electroplating power to a plurality of concentric anodes disposed at different positions within the principal fluid flow chamber relative to the workpiece because this would have resulted in depositing a conductive material

such as copper on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the desired properties as taught by Wilson (page 2, [0010] and [0011]).

XIV. Claims **68 and 69** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1).

Reid '796 teaches a process for applying a metallization interconnect structure, comprising:

(a) providing a workpiece **10** on which a metal seed layer **18** has been formed;

(b) repairing the seed layer by electrochemically depositing additional metal on the seed layer within a principal fluid chamber of a reactor to provide an enhanced seed layer (cols. 5-6, "Initiation Phase");

(c) electrolytically depositing copper on the enhanced seed layer (col. 6, "Bottom-up Filling Phase") under conditions in which the deposition rate of the electrolytic deposition process is substantially greater than the deposition rate of the process used to repair the metal seed (col. 8, lines 40-47) utilizing an electroplating composition comprising a mixture of copper and sulfuric acid wherein the ratio in g/L of copper to acid is equal to about 0.4 to about 0.8 (col. 8, Table 2), a copper-deposition suppressor (col. 4, lines 26-36), and a copper-deposition accelerator (col. 4, lines 10-25).

The electroplating composition comprises a mixture of copper and sulfuric acid

wherein the ratio in g/L of copper to acid is equal to about 0.3 to about 0.8 (col. 8, Table 2).

The method of Reid '796 of differs from the instant invention because Reid '796 does not disclose using a deposition process comprising supplying electroplating power to a plurality of electrodes within the principal fluid flow chamber.

Like Reid '796, Wilson teaches a process for applying a metallization interconnect structure. Wilson teaches that the current is applied by a plurality of electrodes in a manner that can account for different plating characteristics at different portions of the workpiece, and the current applied to individual electrodes is changed to account for changes in behavior as thickness of the conductive material on the workpiece increases. As a result, conductive material such as copper are deposited on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the desired properties (page 2, [0010] and [0011]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Reid '796 by using a deposition process comprising supplying electroplating power to a plurality of concentric anodes disposed at different positions within the principal fluid flow chamber relative to the workpiece because this would have resulted in depositing a conductive material such as copper on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the desired properties as taught by Wilson

(page 2, [0010] and [0011]).

Wilson also teaches independently controlling the supply of electrical power to the at least two electrodes during repair of the seed layer (page 11, [0092]).

Citations

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Grandikota et al. (US Patent Application Publication No. 2002/0112964 A1) is cited to teach a method for plating a metal into high aspect ratio features, comprising:

(a) disposing a substrate and an anode in a plating solution, the solution comprising:

(i) metal ions at a molar concentration of between about 0.4 M and about 0.9 M;

(ii) an acid at a concentration of between about 4 gm/L and about 60 gm/L;

(iii) a suppressor at a concentration of between about 2 mL/L and about 15 mL/L;

(iv) an accelerator at a concentration of between about 1.5 mL/L and about 8 mL/L;

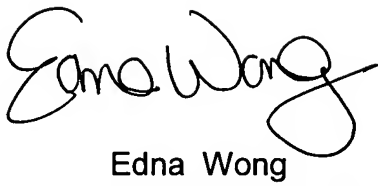
(v) a leveler at a concentration of between about 2 mL/L and about 11 mL/L; and

(b) plating metal ions from the plating solution into the features.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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